Reg.No.										

INTERNATIONAL CENTRE FOR APPLIED SCIENCES

(Manipal University)

II SEMESTER B.S. DEGREE EXAMINATION – NOV. 2017

SUBJECT: FLUID MECHANICS (ME 122)

(BRANCH: MECH /AVI)

Thursday, 23 November 2017

Time: 3 Hours **Max. Marks: 100**

- ✓ **Answer ANY FIVE full Questions.**
- ✓ **Missing data, if any, may be suitably assumed**

1A. Distinguish between

(a) Velocity potential function and stream function
(b) Uniform and non uniform flow
(c) Dynamic and kinematic similarity
(d) Specific gravity and specific weight
(e) Pascal's law and hydrostatic law.

1B. A shaft of diameter 180 mm is rotating inside a journal bearing of 181.2 mm at a speed of 120 rpm. The space between the shaft and the bearing is filled with a lubricating oil. Determine the viscosity of oil if a torque of 20 Nm is required to rotate it. Both the cylinders are 300 mm high. **(10+10)**

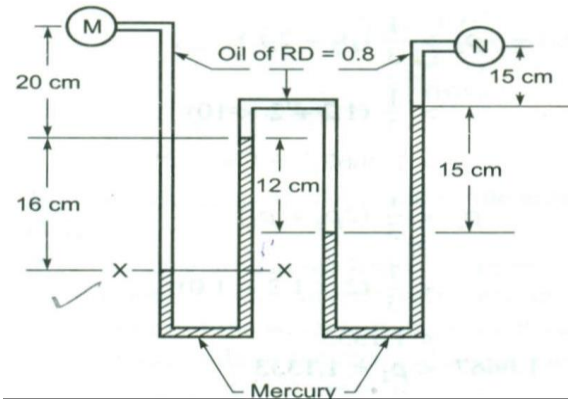
2A. Derive Darcy weisbatch equation for the determining the losses in a pipe flow.

2B. A pump has 30 cm diameter suction pipe and 25cm diameter delivery pipe. When 220 L/s of water was pumped pressure on the suction side of the pump was 4 m of vacuum and on the delivery side the pressure was 100 kPa. Assuming asn efficiency of 50% for pump motor set estimate the electrical power consumed. **(10+10)**

3A. Derive an expression for velocity distribution for the flow of viscous fluid in a circular pipe and hence show that average velocity is half of the maximum velocity

3B. Determine the pressure difference (P_M-P_N) when the manometer indicates the reading as shown in figure 1. **(10+10)**

Figure 1.



4A. With usual notations derive an expression to determine the discharge through an orificemeter.

4B. A sector gate in the form of a circular arc of radius 5 m retains water to a height of 4m above its sill as shown in figure 2. Calculate the magnitude and direction of the resultant force if the length of the gate is 3 meters. **(10+10)**

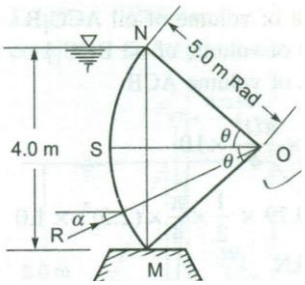


Figure.2

5A. Define equation of continuity. Obtain an expression for continuity equation for a 3 dimensional flow.

5B. Stream function is given by Ψ = 2xy. Calculate the velocity at the point P (2, 3). Find the velocity potential function. **(10+10)**

6A. An inclined venturimeter is used to measure the flow of water in a pipe of diameter 15 cm. Differential mercury manometer is connected to the inlet and throat. Maximum range available in the differential manometer is 30 cm of mercury deflection. Find the maximum throat diameter when the flow rate is 0.026m^3/s. Take coefficient of discharge as 0.98.

6B. A wooden cylinder of specific gravity 0.75 and circular in cross section is required to float in water. Find L/D ratio for the cylinder to float with its longitudinal axis vertical in oil where L is the height of the cylinder and D is the diameter. **(10+10)**

7A. With sketches explain the stability conditions for a submerged and a floating body

7B. Define and explain the following non dimensional number with reference to fluid flow problems

(a) Reynolds' number (b) Mach number

7C. The rate of flow through horizontal pipe is 0.25 m^3/s. Diameter of the pipe is 200 mm is suddenly enlarged to 400 mm. pressure intensity in the smaller pipe is 11.722 N/cm2. Determine (i) loss of head due to sudden enlargement (ii) Pressure intensity in the larger pipe (iii)Power lost **(6+4+10)**

8A. The lift force F on an aero foil is a function of angle of attack α, velocity of flow V, chord length C, span L, density ρ, viscosity μ, bulk modulus of elasticity E. show by using bucking ham's π theorem that

$$\frac{F}{\rho V^2 L^2} = \phi\left(\frac{\rho VC}{\mu}, \frac{V\sqrt{\rho}}{\sqrt{E}}, \frac{L}{C}, \alpha\right)$$

8B. Glycerine (μ =1.5 Pa.s and density 1260 kg/m^3) flows at a velocity of 5 m/s in a 10 cm diameter pipe. Estimate

(a) Head loss in a length of 12 m

(b) Power expended by the flow in a length of 12 m. **(10+10)**